

BEE DIVERSITY AND FLORAL HOSTS IN SELECTED HABITATS OF THE PERADENIYA UNIVERSITY PARK

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ABSTRACT

A study of the bee diversity and floral hosts in 5 selected habitats of the Peradeniya University Park documented 48 species of bees in 21 genera and 4 families, Anthophoridae, Apidae, Halictidae and Megachilidae. Majority (43.75%) of the bees belonged to the family Halictidae and to the genus *Lipotriches* (*Nomia*). All 4 species of Apidae bees *Apis cerana*, *A. dorsata*, *A. florea* and *Trigona iridipennis* were present at the study sites. The floral hosts of bees comprised 26 plant species in 12 families. Majority of the floral hosts of bees belonged to the family Asteraceae. Among the floral hosts were 2 endemic species of weeds namely; *Argyrea populifolia* (Convolvulaceae) and *Hedyotis corymbosa* (Rubiaceae). The bee diversity appears to be determined by the availability of suitable floral hosts more than the degree of disturbance to the habitats. Rice fields, weedy areas and builtup areas had the highest diversity of bees. Flowers of *Spermacoce* sp. attracted the highest number of bee species. The majority of the bees were polylectic with only 4 bee species being host plant specific.

Key words

Peradeniya University Park, Bees, Diversity, Floral hosts, Sri Lanka

INTRODUCTION

Studies on site specific fauna have been directed mostly towards vertebrates, due to easy sightings and identification. Although arthropods in general and insects in particular constitute about 75% of the fauna of any habitat, such studies are scarce due to the small size of insects and the discrete nature of microhabitats occupied by them. Nevertheless, the contribution made by insects towards overall biodiversity is unquestionable.

Due to the dearth of taxonomists in most developing countries, site specific insect fauna has received little attention. However, even when taxonomic expertise is available for selected groups, few overall site surveys have been attempted. The reasons for the paucity of such studies have been elaborated by Deyrup and Edirisinghe (2000, personal communication).

Of all the different groups of insects, bees in particular are a subject of investigation by several scientists in the developed and the developing world. This

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is mainly because they play an important role in pollination to produce fruits, nuts and seeds, a great percentage of which make up the diets of other insects, animals and humans. The seeds produced are responsible for plant propagation. The value of insect pollination, mostly by bees, is not limited to cultivated crops. Bohart (1952) pointed out that the most drastic effect of the absence of pollinating insects would be in uncultivated areas, where as a result, most soil holding and soil enriching plants would die out.

Some surveys of bee pollinators in limited sites have been carried out in the U.S.A. (Graenicher, 1930, Evans, 1986, and Marlin & LaBerge, 2001), in Europe (Banaszak, 1987, Westrich, 1989-1990) and in Punjab, India (Batra, 1968), for example. In Sri Lanka, there are no previous studies on site related insect fauna, conducted or published, to the knowledge of the authors. The present site specific study on bees was made possible by the ongoing study on the taxonomy of bees of Sri Lanka conducted by the authors, and the recent publication of the checklist of bees of Sri Lanka (Wijesekara, 2001).

Five habitats in the Peradeniya University Park near Kandy were selected for the study. Although the University Park comprises 10 habitats, in 700 hectares, some are located in inaccessible places with unapproachable terrain and hence, cannot be visited regularly. Therefore, the sites selected for the study were based on easy access and the degree of disturbance. Based on these criteria, 5 habitats were selected for the study of the bee fauna.

The objective of the present study was to collect and identify the bees associated with these 5 selected habitats with different vegetation types. The floral hosts of bees were also recorded.

MATERIALS AND METHODS

Study sites

The 5 selected habitats and a description of their vegetation and location are given in Table 1. The selected habitats were rice fields, weedy areas, scrublands, roadsides and built up areas in the Peradeniya University Park. Within these 5 selected habitats certain areas were surveyed fortnightly for bees. The rice fields are man-made ecosystems and subject to rice cultivation practices during 'yala' (May-September) and 'maha' (October-January) seasons, in between the fields are cultivated with vegetables. The built-up area and the roadsides are being continuously slashed and cleared to control the 'mana grass' (*Panicum maximum*) and other invasive weeds. The remaining habitats; weedy areas and the scrublands are subjected to cattle grazing. The 5 habitats were visited at different intervals and seasons over a period of 1½ years for collection of bees and recording floral hosts.

Table 1
Description of the five selected habitats (total extent surveyed ca. 10 ha)

Habitat	Description
Rice fields (0.5 ha)	Bounded by a small stream and a road. Fully exposed to sun. A small-scale farmer fields among homesteads.
Road sides (2.5 ha)	Along minor road of the campus. Vegetation on either side comprised of weeds, creepers and bushes.
Weedy areas (0.5 ha)	An open area along a cliff. Fully exposed to sun. Few flowering weeds dominated by <i>Spermacoce</i> sp.
Built up areas (5.5 ha)	Around major buildings of the University where ornamental flowerbeds occur among weeds and creepers.
Scrub land (1.0 ha)	Shady areas with mixed vegetation, with only <i>Lantana camara</i> in bloom.

Collection and Identification of bees

Bees were collected while on flowers or in flight using a hand net. Collected specimens were curated and identified. For the purpose of identification, taxonomic keys and reference collections from different sources were used. Family identification was based on Michener (1970). For the identification of bee genera and subgenera, keys given in Michener (2000) was used. Identification of species was based on keys and descriptions of Bingham (1897), and the bee reference collections in the Department of Zoology, University of Peradeniya and at the Department of National Museums, Colombo, made possible through the Sri Lanka - Smithsonian survey. The identity of difficult specimens were confirmed by specialists; Dr. S. Batra formerly of USDA, Beltsville, USA and Dr. B. Norden of the Smithsonian Institution. Floral host plants were identified by the help of the National Herbarium, Peradeniya.

RESULTS

Species composition of bees

A total of 48 bee species belonging to 21 genera and 4 families (Anthophoridae, Apidae, Halictidae and Megachilidae) were collected from the 5 selected habitats (Table 2). The majority of the bees collected belonged to the families Halictidae and Anthophoridae, represented by 21 and 15 species respectively. The family Apidae that includes the social bees was represented by all 3 species of *Apis* bees recorded for Sri Lanka and the single stingless bee, *Trigona iridipennis*.

Table 2
Diversity of bees in the selected habitats

Family	Genera	Species
Anthophoridae	07	15
Apidae	02	04
Halictidae	09	21
Megachilidae	03	08
Total	21	48

The largest genus of bees at the University Park, *Lipotriches* (Halictidae) is consisted of 9 species of bees in 2 nomiine subgenera; *Lipotriches* and *Austronomia* (Appendix 1). To the family Halictidae belonged *Ceratina* (*Neoceratina*) sp. 1; which was the smallest bee collected (size 3-4 mm). The most colourful of the bees belonged to the family Anthophoridae. Bees of the genus *Pithitis* are metallic blue-green in colour and some *Amegilla* spp. have blue stripes. The common carpenter bees (Anthophoridae) were represented by a single species, *Xylocopa* (*Ctenoxylocopa*) *fenestrata*, which was the largest bee collected (size 30-32 mm).

Among the bees collected were 3 species of parasitic bees, namely *Thyreus takaonis*, *T. histrio*, and *Sphecodes* sp. 1.

Diversity of bees in the different habitats

Of the 5 habitats surveyed, bee diversity was high in the rice fields (24 spp.), weedy areas (24 spp.) and in the built up areas (21 spp.) (Table 3 and Fig. 1). From the scrub land only a single bee species, *Amegilla scintillans*, was collected. Several of the collected bees were present in almost all the habitats. However, a few species, such as *Braunsapis* sp. 2, *Ceylalictus* (*Ceylalictus*) *cereus*, and *Thyreus histrio* were confined to specific habitats (Appendix 1).

Table 3
Taxonomy of the bees collected from the five habitats

Habitat	Bee Family				Species
	Anthophoridae	Apidae	Halictidae	Megachilidae	
Rice fields	08	02	12	02	24
Road sides	05	01	05	01	12
Weedy areas	07	04	08	05	24
Built up area	06	02	10	03	21
Scrub lands	01	00	00	00	01

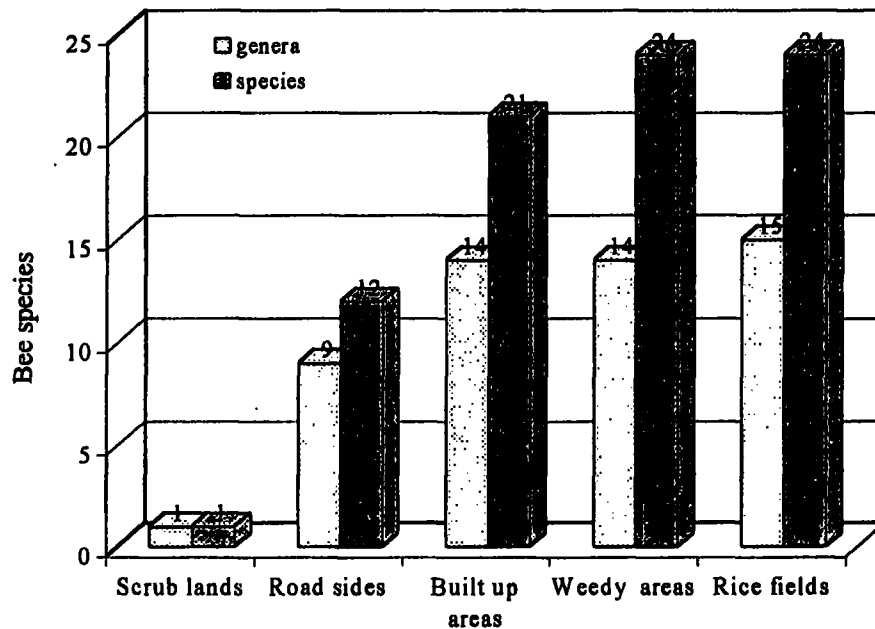


Figure 1. Distribution of bee genera and species in the 05 habitats

In all the habitats, halictids were the most common bees in terms of number of species. In terms of individual numbers, the common honeybee, *Apis cerana*, were seen, especially in the weedy areas. Feral colonies or domesticated bee colonies of *A. cerana* were not found in the vicinity of the study sites, however, honeybees have a long flight range. Roadsides, which are the most disturbed habitats, had moderate bee diversity (Table 3). Of the selected habitats, the built up areas and rice fields were observed to have diverse flowering vegetation comprising several plant families of ornamental plants and weeds (Table 4) (no effort was made to document the species composition of the vegetation in any of the habitats). Although the built up area contained several ornamental plants, the majority of the bees were collected from flowers of weeds that grew between flowerbeds.

Table 4
Floral hosts of bees in the five habitats

Habitat	Plant family	No. of floral host species
Rice fields	Asteraceae, Capparidaceae, Commelinaceae, Convolvulaceae, Lamiaceae, Rubiaceae, Verbenaceae	11
Road sides	Asteraceae, Commelinaceae, Convolvulaceae, Malvaceae, Verbenaceae	06
Weed patches	Convolvulaceae, Fabaceae, Pedaliaceae, Rubiaceae	04
Built up areas	Acanthaceae, Asteraceae, Convolvulaceae, Cyperaceae, Fabaceae, Rubiaceae	12
Scrub lands	Verbenaceae	01

List of bees

Following is a list of bees with their floral hosts. Bees are listed alphabetically under their generic and species names. The name given within brackets after the genus of bees refers to its subgenus. In this list, the status of plants are indicated as cultivated crops (C), endemics (En), exotic (Ex) and indigenous (I), after the species name. No attempt was made to match the pollen of floral hosts on which the bees were collected. This is a subject of an on-going study.

Amegilla niveocincta Smith

Flowers; *Leucas zeylanica* (I), *Sesamum radiatum* (I)

Amegilla puttalama (Strand)

Flowers; *Leucas zeylanica* (I), *Stachytarpheta dichotoma* (Ex)

Amegilla scintillans Lieftinck

Flowers; *Asystasia coromandelica* (I), *Jacobina tinctorina* (Ex),
Lantana camara (Ex), *Stachytarpheta indica* (I)

Amegilla Friese. spp.

Flowers; *Leucas zeylanica* (I), *Stachytarpheta dichotoma* (Ex)

Apis cerana Fabricius

Flowers; *Asystasia coromandelica* (I), *Crotalaria pallida* (I), *Oryza sativa*
(I, C), *Stachytarpheta dichotoma* (Ex), *Solanum melongena* (Ex, C)

Apis dorsata Fabricius

Flowers; *Spermacoce* sp. (Ex)

Apis florea Fabricius

Flowers; *Oryza sativa* (I, C), *Spermacoce* sp. (Ex)

Braunsapis Michener spp.

Flowers; *Ageratum* sp. (Ex), *Cleome viscosa* (I), *Hedyotis corymbosa* (En),
Spermacoce sp. (Ex), *Stachytarpheta indica* (I), *Vernonia cinerea* (I)

Ceratina (*Neoceratina*) Perkins sp. 1

Flowers; *Hedyotis corymbosa* (En)

Ceratina (*Ceratinida*) *hieroglyphica* Smith

Flowers; *Argyreia populifolia* (N), *Crotalaria pallida* (I), , *Ipomoea*
cairica (I), *Stachytarpheta indica* (I), *Spermacoce* sp. (Ex), *Jacobina*
tinctoria (Ex), *Wedelia biflora* (I)

Ceylalictus (Ceylalictus) cereus* (Nurse)**Flowers; *Spermacoce* sp. (Ex)Halictus (Seladonia) lucidipennis* Smith**Flowers; *Ageratum* sp. (Ex), *Tridax procumbens*(Ex), *Vernonia cinerea* (I)***Heriades binghami* Dover**Flowers; *Bidens pilosa*(Ex), *Hedyotis corymbosa*(En), *Vernonia cinerea*(I)***Lasioglossum (Ctenonomia)* Cameron sp. 1**Flowers; *Bidens pilosa* (Ex), *Commelina kurzii* (I)***Lasioglossum (Nesohalictus) serenum* (Cameron)**Flowers; *Argyreia populifolia* (En), *Fimbristylis eragrostis* (I), *Ipomoea cairica* (I)***Lipotriches (Austronomia) krombeini* Hirashima**Flowers; *Hedyotis corymbosa* (En)***Lipotriches (Austronomia) notiomorpha* Hirashima**Flowers; *Ageratum* sp. (Ex), *Commelina kurzii* (I), *Spermacoce* sp. (Ex)***Lipotriches (Austronomia)* Michener sp. 1**Flowers; *Justicia procumbens* (I), *Spermacoce* sp. (Ex)***Lipotriches (Austronomia) ustula* Hirashima**Flowers; *Cuscuta chinensis* (I), *Vernonia cinerea* (I)***Lipotriches (Lipotriches)* Gerstaeckers. str. sp. 1**Flowers; *Justicia procumbens* (I)***Lipotriches (Lipotriches)* Gerstaecker s. str. sp. 4**Flowers; *Ageratum* sp. (Ex), *Commelina kurzii* (I), *Spermacoce* sp. (Ex)***Lipotriches (Lipotriches)* Gerstaecker s. str. sp. 5**

Off vegetation

Lipotriches (Lipotriches)* Gerstaecker s. str. sp. 7**Flowers; *Commelina kurzii* (I)Lipotriches (Lipotriches)* Gerstaecker s. str. sp. 8**Flowers; *Emilia alstonii* (I), *Mitracarpus hirtus* (Ex)

The genus formerly known as *Nomioides* in Sri Lanka is now referred to as *Ceylalictus*.
The members of the genus *Lipotriches* was formerly included under *Nomia* (Michener, 2000).

***Lithurgus (Lithurgus) atratus* Michener**

Flowers; *Argyreia populifolia* (En), *Hisbiscus furcatus* (I), *Ipomoea cairica* (I)

***Lithurgus dentipes* Smith**

Flowers; *Argyreia populifolia* (En), *Ipomoea cairica* (I)

***Megachile conjuncta* Smith**

Flowers; *Crotalaria pallida* (I)

***Megachile hera* Bingham**

Flowers; *Tridax procumbens* (Ex)

***Megachile (Pseudomegachile) lanata* (Fabricius)**

Flowers; *Crotalaria pallida* (I)

***Megachile vestita* Smith**

Flowers; *Sesamum radiatum* (I)

***Megachile vigilans* Smith**

Flowers; *Vernonia cinerea* (I)

***Nomia (Acunomia) formosa* Smith**

Off vegetation

***Nomia (Hoplonomia) westwoodii* Gribodo**

Flowers; *Cleome viscosa* (I), *Jacobina tinctoria* (Ex), *Spermacoce* sp. (Ex),
Stachytarpheta indica (I)

***Nomia (Leuconomia) Pauly* sp. 4**

Flowers; *Commelina kurzii* (I)

***Patellapis (Pachyhalictus) kaluterae* (Cockerell)**

Flowers; *Spermacoce* sp. (Ex)

***Patellapis (Pachyhalictus)* Cockerell sp. 2**

Flowers; *Spermacoce* sp. (Ex)

***Patellapis (Pachyhalictus)* Cockerell sp. 3**

Flowers; *Cuscuta chiensis* (I)

***Pithitis binghami* Cockerell.**

Flowers; *Crotalaria pallida* (I), *Jacobina tinctoria* (Ex), *Stachytarpheta dichotoma* (Ex), *Spermacoce* sp. (Ex)

***Pseudapis (Pseudapis) oxybeloides* Smith**

Flowers; *Desmodium heterophyllum* (I), *Fimbristylis eragrostis* (I),
Solanum melongena (Ex, C)

***Sphecodes* Latreille sp. 1**

Flowers; *Cuscuta chinensis* (I), *Vernonia cinerea* (I)

***Tetralonia (Thygatina)* Cockerell sp. 1**

Flowers; *Argyreia populifolia* (En)

***Tetralonia (Thygatina)* Cockerell sp. 3**

Flowers; *Hibiscus furcatus* (I)

***Thyreus histrio* (Fabricius)**

Flowers; *Jacobina tinctoria* (E), *Leucas zeylanica* (I)

***Thyreus takaonis* (Cockerell)**

Flowers; *Leucas zeylanica* (I)

***Trigona iridipennis* Smith**

Flowers; *Cuscuta chinensis* (I), *Leucas zeylanica* (I), *Spermacoce* sp. (Ex),
Solanum melongena (Ex, C), *Vigna unguiculata* (I, C)

***Xylocopa (Ctenoxylocopa) fenestrata* (Fabricius)**

Flowers; *Crotalaria pallida* (I)

List of floral hosts of bees

Following is a list of flower species with the bee species that visited the respective plant. Plant names are listed alphabetically with their authority, plant family. Letters (m, f) after each bee species refer to the gender (male/female) of the bee.

***Ageratum* L. sp. (Asteraceae) (Ex)**

Bees; *Halictus (Seladonia) lucidipennis* (m,f), *Lipotriches (Lipotriches)* sp. 4 (m), *Pseudapis (Pseudapis) oxybeloides* (m,f), *Lipotriches (Austronomia) notiomorpha* (f), *Braunsapis* sp. 1 (f)

***Argyreia populifolia* Choisy (Convolvulaceae) (En)**

Bees; *Tetralonia (Thygatina)* sp. 1 (m,f), *Lasioglossum (Nesohalictus) serenum* (m,f), *Ceratina hieroglyphica* (f), *Lithurgus dentipes* (f), *Lithurgus atratus* (f)

***Asystasia coromandelica* Wight ex Nees (Acanthaceae) (I)**

Bees; *Apis cerana* (f), *Amegilla scintillans* (m)

***Bidens pilosa* L. var. *minor* (Blume) Sherff. (Asteraceae) (Ex)**

Bees; *Heriades binghami* (f), *Lasioglossum (Ctenonomia)* sp. (m)

***Cleome viscosa* L. (Capparidaceae) (I)**

Bees; *Nomia (Hoplonomia) westwoodii* (m), *Braunsapis* sp. 1 (f),
Pseudapis (Pseudapis) oxybeloides (m)

***Commelina kurzii* C. B. Cl (Commelinaceae) (I)**

Bees; *Lipotriches (Austronomia) notiomorpha* (f), *Lipotriches (Lipotriches)*
sp. 7 (f), *Lipotriches (Lipotriches)* sp. 4 (m), *Nomia (Leuconomia)* sp. 4
(m,f), *Lasioglossum (Ctenonomia)* sp. (f)

***Crotalaria pallida* Ait. (Fabaceae) (I)**

Bees; *Xylocopa (Ctenoxylocopa) fenestrata* (f), *Apis cerana* (f), *Megachile*
lanata (f), *Megachile conjuncta* (f), *Ceratina hieroglyphica* (f), *Pithitis*
binghami (f)

***Cuscuta chinensis* Lam. (Convolvulaceae) (I)**

Bees; *Lipotriches (Austronomia) ustula* (m), *Sphecodes* sp. 1 (f), *Trigona*
iridipennis (f), *Patellapis (Pachyhalictus)* sp. 3 (f)

***Desmodium heterophyllum* (Willd.) DC (Fabaceae) (I)**

Bees; *Pseudapis (Pseudapis) oxybeloides* (f)

***Emilia alstonii* Fosberg. (Asteraceae) (I)**

Bees; *Lipotriches (Lipotriches)* sp. 8 (m)

***Fimbristylis eragrostis* (Nees & Meyen) Hance. (Cyperaceae) (I)**

Bees; *Pseudapis (Pseudapis) oxybeloides* (m), *Lasioglossum*
(Nesohalictus) serenum (f)

***Hedyotis corymbosa* (L.) Lamk (Rubiaceae) (En)**

Bees; *Lipotriches (Austronomia) krombeini* (m,f), *Pseudapis (Pseudapis)*
oxybeloides (m,f), *Braunsapis* sp. 2 (f), *Ceratina (Neocetarinaa)* sp. 1
(m,f), *Heriades binghami* (m)

***Hisbiscus furcatus* Willd. (Malvaceae) (I)**

Bees; *Lithurgus atratus* (f), *Tetralonia (Thygatina)* sp. 3 (f)

***Ipomoea cairica* (L.) Sweet (Convolvulaceae) (I)**

Bees; *Lithurgus atratus* (f), *Lithurgus dentipes* (f), *Lasioglossum* (*Nesohalictus*) *serenum* (f), *Ceratina hieroglyphica* (m,f)

***Jacobina tinctoria* (Acanthaceae) (Ex)**

Bees; *Amegilla scintillans* (m,f), *Thyreus histrio* (m), *Ceratina hieroglyphica* (f), *Pithitis binghami* (f), *Nomia* (*Hoplonomia*) *westwoodii* (m,f)

***Justicia procumbens* L. (Acanthaceae) (I)**

Bees; *Lipotriches* (*Lipotriches*) sp. 1 (m), *Heriades binghami* (f), *Lipotriches* (*Austronomia*) sp. 1 (f)

***Lantana camara* var. *aculeata* (L.) Moldenke (Ex)**

Bees; *Amegilla scintillans* (f)

***Leucas zeylanica* (L.) R. Br. (Lamiaceae) (I)**

Bees; *Amegilla puttalama* (f), *Thyreus histrio* (m,f), *Thyreus takaonis* (f), *Amegilla* sp. 1 (f), *Trigona iridipennis* (f)

***Mitracarpus hirtus* (L.) DC. (Rubiaceae) (Ex)**

Bees; *Lipotriches* (*Lipotriches*) sp. 8 (m)

***Oryza sativa* L. (I, C)**

Bees; *Apis cerana* (f), *Apis florea* (f)

***Sesamum radiatum* Schum. (Pedaliaceae) (I)**

Bees; *Amegilla niveocincta* (m), *Megachile vestita* (m)

***Solanum melongena* L. (Ex, C)**

Bees; *Trigona iridipennis* (f), *Pseudapis* (*Pseudapis*) *oxybeloides* (f), *Apis cerana* (f).

***Spermacoce* L. sp. (Rubiaceae) (Ex)**

Bees; *Apis dorsata* (f), *Apis florea* (f), *Trigona iridipennis* (f), *Braunsapis* sp. 2 (f), *Braunsapis* sp. 1 (f), *Patellapis* (*Pachyhalictus*) *kaluterae* (f), *Lipotriches* (*Lipotriches*) sp. 4 (m), *Lipotriches* (*Austronomia*) *notiomorpha* (m), *Lipotriches* (*Austronomia*) sp. 1 (m,f), *Nomia westwoodii* (f), *Ceratina hieroglyphica* (f), *Pithitis binghami* (f), *Ceylalictus* (*Ceylalictus*) *cereus* (f), *Patellapis* (*Pachyhalictus*) sp. 2 (f)

***Stachytarpheta dichotoma* (Ruiz & Pav.) Vahl. (Verbenaceae) (Ex)**

Bees; *Apis cerana* (f), *Pithitis binghami* (f), *Amegilla* sp. 2 (m,f)

***Stachytarpheta indica* (L.) Vahl. (Verbenaceae) (I)**

Bees; *Amegilla scintillans* (m,f), *Nomia (Hoplonomia) westwoodii* (f), *Ceratina hieroglyphica* (f), *Braunsapis* sp. 2 (f), *Ceylalictus (Ceylalictus) cereus* (m)

***Tridax procumbens* L. (Asteraceae) (Ex)**

Bees; *Halictus (Seladonia) lucidipennis* (f), *Megachile hera* (f)

***Vernonia cinerea* (L.) Less. (Asteraceae) (I)**

Bees; *Megachile vigilans* (f), *Halictus (Seladonia) lucidipennis* (f), *Heriades binghami* (f), *Braunsapis* sp. 1 (f), *Lipotriches (Austronomia) ustula* (f), *Sphecodes* sp. 1 (f), *Ceratina hieroglyphica* (f)

***Vigna unguiculata* (L.) Walp (I)**

Bees; *Trigona iridipennis* (f)

***Wedelia biflora* (L.) DC. (Asteraceae) (I)**

Bees; *Ceratina hieroglyphica* (f)

DISCUSSION**New records of bees**

According to the recent publication by Wijesekara (2001), 138 bee species in 25 genera and 5 families have been listed for Sri Lanka. The present survey carried out within the University Park documents 2 genera and 4 species of bees not listed in Wijesekara (2001). Of them, the two genera, *Heriades binghami* and *Sphecodes* sp. 1 are present in the collection of the Sri Lanka – Smithsonian Survey. The genus *Sphecodes* includes parasitic bees that are not commonly seen on flowers, but are usually associated with the nesting sites of their host bees, the Halictidae.

The 2 species, *Lithurgus dentipes* and *Ceratina (Neoceratina) sp. 1*, however, have not been documented previously and hence can be considered as new records for Sri Lanka. Bingham (1897) has described the former species from Sikkhim, Manipuri, Tenasserim and Netherlands. Michener (2000) has described the sub genus of *Ceratina (Neoceratina) sp. 1* from the Palearctic, Oriental and Australian region.

Paucity of the bee fauna

About 1/3 of the total number of bees recorded for Sri Lanka (138 spp.) and about the same number of genera were documented during the present study. Hence, it appears that the bee diversity is relatively high in the selected habitats (app. 10 ha in extent) of the University Park. However, similar but more extensive surveys done in other parts of the world have revealed much higher bee diversity. For example, the 600 ha. site in the campus of Punjab Agricultural University yielded 97 species of bees during a 9 month survey (Batra, 1968). A multiyear study conducted in Florida, USA in a 2105 ha. site at the Archbold Biological Station revealed the presence of 111 species of bees on 146 species of floral hosts (Deyrup and Edirisinghe, personal communication). The small size of the bee fauna at this extensive site has been correlated with the climatic conditions, vegetation types and soil types. However, with regard to the present study, apart from the vegetation types, differences in soil or terrain were not taken into account. This study reveals that the bee diversity is high in habitats with a high floral diversity, irrespective of whether they are disturbed habitats or not. This was very evident in the scrub-lands where only the exotic weed *Lantana camara*, (Verbenaceae) was in bloom during the study period among several other flowering plants that were not in bloom. Furthermore, *Lantana camara*, which is known to be pollinated by Lepidoptera, attracted only a single species of bees, *Amegilla scintillans* (Anthophoridae) that has a long tongue. Even though many weeds were in bloom, a strong attraction for small flowers of the weed *Spermacoce* sp. (Rubiaceae) was evident from the 14 species of small bees that visited it. Such tiny flowers perhaps offer many rewards to tiny bees.

The majority of the documented bees from the different habitats were generalists or polylectic bees in that they visited several floral hosts. However, 4 species of bees collected during the study were found to be oligolectic in that they visited 1 or 2 types of floral hosts only. Thus, *Tetralonia* (*Thygatina*), sp. 1 and 3 visited only *Argyreia populifolia* and *Hibiscus furcatus* respectively. *Lithurgus atratus* and *L. dentipes* were confined mostly to the Convolvulaceae with the flowers of *Argyreia populifolia* and *Ipomoea cairica* being visited. Furthermore, these oligolectic bees were not habitat specific but visited their floral hosts wherever they were found.

The 3 species of parasitic bees that were documented during this study may reflect the proportion of parasitic bees in the entire bee fauna of Sri Lanka. According to the checklist of Wijesekara (2001) 17 % of our bees are parasitic. Although the parasitic bees were collected from flowers they are not pollen collectors but visit flowers only to feed themselves and to find mates. Parasitic bees lay their eggs in nests of other bee species for their larvae to be fed on the pollen provisioned by the host bee. *Sphecodes* sp. 1 (Halictidae) that is known to be parasitic in the ground nests of *Halictus* (*Seladonia*) *lucidipennis* (S. Batra, personal communication) was found on flowers of *Vernonia cinerea* and *Cuscuta chinensis*. The other 2 species of parasitic bees, *Thyreus histrio* and *Thyreus takaonis* (Anthophoridae) are known to parasitize the under ground nests of *Amegilla* species.

The present checklist of bees (Wijesekara, 2001) of Sri Lanka numbering 138 species in 25 genera reflects an overall paucity in our bee fauna. Within a small island of 65,525 sq. km in extent and reaching elevations of over 2000 m a much higher bee diversity is to be expected. The absence of any endemic bee species in Sri Lanka too reflects the paucity of our fauna. Sri Lanka being an island with a very high floral diversity comprising 3,800 species of flowering plants (of which 23% are endemic) should harbour a rich bee fauna. It is likely that intensive surveys covering all the agro-ecological regions of the country would reveal a much richer bee fauna than is presently recorded.

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Appendix 1

Distribution of bees in selected habitats of the University Park

Bee family/species	Rice fields	Road sides	Weedy areas	Built up areas	Scrub lands
Anthophoridae					
<i>Amegilla niveocincta</i>			✓		
<i>Amegilla puttalama</i>	✓				
<i>Amegilla scintillans</i>		✓		✓	✓
<i>Amegilla</i> sp. 1	✓				
<i>Amegilla</i> sp. 2	✓				
<i>Braunsapis</i> sp. 1	✓	✓	✓	✓	
<i>Braunsapis</i> sp. 2			✓	✓	
<i>Ceratina</i> (<i>Neoceratina</i>) sp. 1				✓	
<i>Ceratina hieroglyphica</i>	✓	✓	✓	✓	
<i>Pithitis binghami</i>	✓		✓	✓	
<i>Tetralonia</i> (<i>Thygatina</i>) sp. 1		✓		✓	
<i>Tetralonia</i> (<i>Thygatina</i>) sp. 3		✓			
<i>Thyreus histrio</i>	✓				
<i>Thyreus takaonis</i>			✓		
<i>Xylocopa</i> (<i>Ctenoxylocopa</i>) <i>fenestrata</i>			✓		
Apidae					
<i>Apis cerana</i>	✓	✓	✓	✓	
<i>Apis dorsata</i>			✓		
<i>Apis florea</i>			✓		
<i>Trigona iridipennis</i>	✓		✓	✓	
Halictidae					
<i>Ceylalictus</i> (<i>Ceylalictus</i>) <i>cereus</i>		✓	✓		
<i>Halictus</i> (<i>Seladonia</i>) <i>lucidipennis</i>		✓		✓	
<i>Lasioglossum</i> (<i>Ctenonomia</i>) sp. 1				✓	
<i>Lasioglossum</i> (<i>Nesohalictus</i>) <i>serenum</i>			✓	✓	
<i>Lipotriches</i> (<i>Austronomia</i>) <i>krombeini</i>				✓	
<i>Lipotriches</i> (<i>Austronomia</i>) <i>notiomorpha</i>	✓	✓	✓	✓	
<i>Lipotriches</i> (<i>Austronomia</i>) <i>ustula</i>	✓				
<i>Lipotriches</i> (<i>Austronomia</i>) sp. 1	✓		✓		
<i>Lipotriches</i> (<i>Lipotriches</i>) sp. 1		✓		✓	
<i>Lipotriches</i> (<i>Lipotriches</i>) sp. 4	✓		✓	✓	
<i>Lipotriches</i> (<i>Lipotriches</i>) sp. 5	✓				
<i>Lipotriches</i> (<i>Lipotriches</i>) sp. 7	✓				

Appendix 1 contd.

Bee family/species	Rice fields	Road sides	Weedy areas	Built up areas	Scrub lands
<i>Lipotriches (Lipotriches) sp. 8</i>	✓			✓	
<i>Nomia (Acunomia) formosa</i>	✓				
<i>Nomia (Hoplonomia) westwoodii</i>	✓	✓	✓	✓	
<i>Nomia (Leuconomia) sp. 4</i>	✓				
<i>Patellapis (Pachyhalictus) kaluterae</i>			✓		
<i>Patellapis (Pachyhalictus) sp. 2</i>			✓		
<i>Patellapis (Pachyhalictus) sp. 3</i>	✓				
<i>Pseudapis (Pseudapis) oxybeloides</i>	✓			✓	
<i>Sphecodes sp. 1</i>	✓				
Megachilidae					
<i>Heraides binghami</i>	✓			✓	
<i>Lithurgus atratus</i>		✓			
<i>Lithurgus dentipes</i>			✓		
<i>Megachile conjuncta</i>			✓		
<i>Megachile hera</i>			✓		
<i>Megachile lanata</i>			✓		
<i>Megachile vestita</i>			✓		
<i>Megachile vigilans</i>			✓		